BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Subsidiary Diploma in Applied Science Pearson BTEC International Level 3 Foundation Diploma in Applied Science Pearson BTEC International Level 3 Diploma in Applied Science Pearson BTEC International Level 3 Extended Diploma in Applied Science Pearson BTEC International Level 3 Extended Diploma in Biomedical Science
Unit number and title	**Unit 21: Applications of Organic Chemistry**
Learning aim(s)	**A:** Understand the structures, isomerism and reactions of functional group compounds
Assignment title	**Functional Group Compounds**
Assessor	
Issue date	
Hand in deadline	

Vocational Scenario or Context	You are a laboratory technician working in an analytical laboratory and in this role you know how typical functional group compounds play an important role in the synthesis of many important industrial and commercial products. They are also used as solvents in many products such as surface coating materials such as paints. They are used by many research projects to support the synthesis of new medically active compounds. They are also used to produce polymer compounds such as polyesters and polyamides such as nylon and Kevlar. It is also important for Chemists and Biochemists to identify and understand the properties of different isomers that are used as drugs in medicine. Because of this your department regularly receives visits from schools, and your supervisor has allocated you the task of testing out an assessment that will be used by the 'BTEC students' undertaking work experience in your laboratory.

Task	Firstly, you will need to **plan** multi-step synthesis routes or maps for three functional group organic compounds. Then you will need to **assess** the biological and industrial importance of isomerism. You must **construct** a mechanism for an addition, substitution, addition-elimination and hydrolysis reaction and **explain** the reactions of difunctional compounds. You must also **explain** types of structural and stereoisomerism and reactions of carbonyl, carboxylic acid and their derivatives, and nitrogen containing compounds. Your final portfolio will comprise of the following 5 sections: Section 1 - Explain the effect of functional groups o **Explain** the reactions of: o typical carboxylic compounds,

	▪ weak acidity of carboxylic acids, reaction with metals, bases, alkalis and carbonates ▪ condensation reaction of carboxylic acids with alcohols with conc H_2SO_4 to form esters ▪ acid and alkaline hydrolysis of ester back into alcohol and carboxylic acid/salt ▪ commercial importance of esters e.g. solvents, flavours and fragrances. ▪ Acyl chlorides and acid anhydrides reactions with water, alcohols, ammonia and amines **o** carbonyl compounds ▪ nucleophilic addition mechanism of HCN to the carbonyl group ▪ nucleophilic addition and formation of optical isomers ▪ reduction with $NaBH_4$ or $LiAlH_4$ to alcohols (and oxidation of alcohols to carbonyls) ▪ addition-elimination mechanisms of aldehydes and ketones reaction with 2, 4-dinitrophenylhydrazine, hydrazine, oxime ▪ oxidation of aldehydes with Tollens' reagent, Benedict's/Fehling's reagents, acidified potassium dichromate, and resistance to oxidation by ketones **o** nitrogen containing compounds and their derivatives ▪ nucleophilic substitution mechanism of amines with halogenoalkanes ▪ comparison of nucleophilic and free radical substitution mechanisms of amines ▪ condensation reaction of amines with acyl chlorides and carboxylic acids to form amides. ▪ alkaline and acid hydrolysis of amides into amine and carboxylic acid (or salts). ▪ Amino acids – difunctional molecule, acid-base characteristics, formation of polyamides/proteins. ▪ Synthesis of commercially important polyamides – nylon and Kevlar Include names formulae, balanced equations, reaction conditions and any products of commercial or biological importance. Section 2 – Mechanisms for an addition, substitution, addition-elimination and hydrolysis reaction o **Construct** and provide an explanation or annotation for at least one correct mechanism for an addition, substitution, addition-elimination

	and hydrolysis reaction for an appropriate organic compound from the list given in Section 1. Consider the stability of any intermediates and any formation of different isomers. (Sourced images of mechanisms are **not** acceptable evidence forms for this criterion.) Section 3 – **Explain** the reactions of difunctional compounds o Reactions of difunctional carboxylic acids and acyl chlorides to form polyesters o Reactions of difunctional amines and acyl chlorides to form polyamides. ® Section 4 - **Explain** and assess different types of isomerism o Use diagrams, molecular models and properties of isomers where appropriate to: o **explain** different types of structural isomers giving at least two examples each of chain, positional and functional group isomers o **explain** different types of stereoisomerism giving at least two examples of geometric and optical isomers. o **Assess** the biological and industrial importance of isomerism using well documented case studies or examples such as optical isomers with different therapeutic properties or use of structural isomers in fuel applications by providing evidence of relevant differences in properties and the possible consequences of not being aware of isomerism. Section 5 - Synthesis routes o **Plan** synthesis routes or maps involving at least two or more steps for each route for the following: ▪ Starting material: dimethylketone, product: methanoic acid ▪ Starting material Dodecane: product: propyl ethanoate ▪ Starting material: But-2-ene, product: N,ethylbutanamide The routes must include names, formulae, balanced equations, reaction conditions and indication of any isomeric compounds formed.
Checklist of evidence required	A research portfolio that includes: • The different types of structural and stereoisomerism

	• The reactions of carbonyl compounds • The reactions of carboxylic acids and their derivatives • The reactions of nitrogen containing compounds • The importance of isomerism in biological and industrial contexts • A range of mechanisms for organic reactions • The reactions of difunctional organic compounds , including polymerisation • 3 multi-step synthesise of functional group organic molecules

Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria, you must show that you are able to:
A.D1	Plan the multi-step synthesis of functional group organic molecules
A.M3	Explain the reactions of difunctional organic compounds, including polymerization
A.M2	Construct a range of mechanisms for organic compounds
A.M1	Assess the importance of isomerism in biological and industrial contexts
A.P4	Explain the reactions of nitrogen containing organic compounds
A.P3	Explain the reactions of carboxylic acids and their derivatives
A.P2	Explain the reactions of carbonyl compounds
A.P1	Explain the different types of structural isomerism and steroisomerism
Sources of information to support you with this Assignment	All sources of information suggested are UK based. Centres are free to amend these sources to those available in the Country of delivery where more appropriate. www.edu.rsc.org - organic chemistry www.STEM.org.uk - organic compounds www.chemhume.co.uk – alcohols, optical isomerism, aldehydes/ketones, amines, polymers www.tes.com – organic synthetic pathways www.chemguide.co.uk –alcohols, aldehydes/ketones, amines, amides, carboxylic acids

	Within the copyright laws learners could search YouTube for:–organic compounds– variety of clips
Notes to the Assessor and technician	Practical work may be undertaken when teaching learners, the unit content in preparation for this assignment, but is not required to complete the assignment itself. Before doing any practical activity, you should always carry out your own risk assessment and refer to the necessary regulations. In particular, any local rules issued by your employer must be obeyed, regardless of what is suggested here. Centre should use Health and Safety information provided by a reputable source. In the UK such an example organization is CLEAPSS http://science.cleapss.org.uk/